Important new records of *Pelomedusa* species for South Africa and Ethiopia

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**Abstract**

Because of a recent taxonomic revision, the species identity of helmeted terrapins (*Pelomedusa*) became unclear in many regions of their wide distribution range. Based on mtDNA sequence data, here we present the first record of *Pelomedusa subrufa* sensu stricto for the South African province of Mpumalanga. In South Africa, this species was previously known only from a single record in the province of Limpopo. In addition, we provide evidence for the occurrence of at least two distinct *Pelomedusa* species in Ethiopia. A sample from southern Ethiopia (Omo Region) turned out as *P. neumanni*, while another sample from Koka Lake (Oromia Region, central Ethiopia) represents *P. somalica*. Also a historical museum specimen from Ethiopia, most likely collected south of the Shebelle River (Oromia Region), belongs to *P. somalica*. However, these two Ethiopian specimens of *P. somalica* represent highly distinct genetic lineages, which may actually correspond to two different species.

**Key words**

*Pelomedusa neumanni*; *Pelomedusa somalica*; *Pelomedusa subrufa*; Pelomedusidae; Reptilia; Testudines.

**Introduction**

Several papers provided evidence that the widely distributed sub-Saharan helmeted terrapins of the genus *Pelomedusa* represent a species complex (Vargas-Ramírez et al. 2010; Wong et al. 2010; Fritz et al. 2011, 2014; Petzold et al. 2014; Nagy et al. 2015) and not a single species as thought before (e.g. Wermuth & Mertens 1977; Fritz & Havaš 2007; Van Duk et al. 2014). The recent revision by Petzold et al. (2014) formally recognized ten distinct *Pelomedusa* species. However, five other genetically distinct lineages have been identified, which may correspond to additional species (Petzold et al. 2014; Nagy et al. 2015). While some of these species and genetic lineages are morphologically distinctive, others are difficult to tell apart using external morphology alone (Fritz et al. 2014, 2015; Petzold et al. 2014). Thus, in many cases, helmeted terrapins need to be studied genetically for reliable species determination. This leads to the uncomfortable situation that many of the old records across Africa (cf. Iverson 1992) cannot be assigned to a certain *Pelomedusa* species.

In Ethiopia, the species identity of all *Pelomedusa* records has become unclear. Helmeted terrapins are widely distributed in this country, with records along the southern border, in the Great Rift Valley, in the Blue
Nile drainage system, and in the east of Ethiopia in the Ogaden Region (Largen & SpaWls 2010). However, two genetically verified museum specimens collected in ‘Abyssinia’ raised the possibility that two distinct species of Pelomedusa, P. gehaife and P. somalica, might occur in Ethiopia (Petzold et al. 2014). These museum specimens from the late 19th and early 20th centuries lacked exact locality data, and when the specimens were collected, Abyssinia was often identified with present-day Ethiopia and Eritrea. Hence, the two terrapins could also have originated from the latter country, where P. gehaife occurs (Fritz et al. 2014; Petzold et al. 2014). Besides Eritrea, there exists only one somewhat questionable record for P. gehaife, from the region of Khartoum, Sudan (Petzold et al. 2014). Genetically verified records of P. somalica are only known from the Awdal Region, Somalia. There, two highly distinct lineages have been recorded approximately 40 km apart (Fig. 1), suggestive of two parapatric or even sympatric species (Vargas-Ramírez at al. 2010; Petzold et al. 2014). For South Africa, the situation is different. There are many genetically verified records, providing evidence for the occurrence of at least two distinct Pelomedusa species, P. galeata and P. subrufa sensu stricto. Like P. somalica, P. galeata is comprised of two deeply divergent genetic lineages, which may actually correspond to two distinct species (Petzold et al. 2014). One of these lineages is widely distributed over most of South Africa, while there are only two sites known for the other one, both in the westernmost range of P. galeata (Northern Cape and Western Cape provinces; Fig. 1). Pelomedusa subrufa sensu stricto, widely distributed from southern Angola and Namibia to East Africa and introduced in Madagascar, has been recorded until now only from the South African province of Limpopo (Hoedspruit, western border region of Kruger Park; Petzold et al. 2014).

In the present paper, we report the second record of P. subrufa sensu stricto for South Africa and the first unambiguous, genetically verified identifications of helmeted terrapins for Ethiopia.
Materials and Methods

We sampled four helmeted terrapins from South Africa (one terrapin each from Eastern Cape, Northern Cape, KwaZulu-Natal, and Mpumalanga) and one from southern Ethiopia (Omo Region; see Fig. 1 and Table 1 for exact locality data). Small pieces of skin or tissue were clipped off and preserved in pure ethanol. Using these samples and the laboratory procedures described for fresh material in Fritz et al. (2014), we sequenced 343-344 bp of the mitochondrial 12S rRNA gene (12S), 671-674 bp of the cytochrome b gene (cyt b), and 810-815 bp of the ND4 gene plus adjacent DNA coding for tRNAs. In addition, using the laboratory procedures for museum material of Fritz et al. (2014), we generated homologous sequence data for a dry specimen from the collection of the Hungarian Natural History Museum, Budapest (HNHM 2004.84.1). This terrapin was collected in the early 1960s in central Ethiopia (Oromia Region; Fig. 1, Table 1), and is figured and described in detail in Dely (1971). For this specimen, we obtained 252 bp of the 12S gene, 319 bp of the cyt b gene, and 435 bp of the ND4 gene. The DNA sequences of each individual were concatenated and merged with the alignment used by Petzold et al. (2014) and Nagy et al. (2015). Then, Maximum Likelihood analyses were calculated as described in Petzold et al. (2014) and the phylogenetic placement of the studied terrapins was used for species identification. GenBank accession numbers of new DNA sequences are LN824005—LN824022.

Results and Discussion

The concatenated sequences of the helmeted terrapins from KwaZulu-Natal, Eastern and Northern Cape, South Africa, clustered together with the more widely distributed clade of Pelomedusa galeata, while the terrapin from Mpumalanga, South Africa, corresponded to P. subrufa sensu stricto (Fig. 2). Also the small size and colour pattern of the Mpumalanga terrapin argue for this species (Fig. 3). Moreover, its triangular pectoral scutes do not meet at the midline, a character sometimes found in P. subrufa sensu stricto, but never in P. galeata (Petzold et al. 2014). This represents the second record of P. subrufa sensu stricto for South Africa and the first record for the province of Mpumalanga. The collection site is approximately 90 km away from the previous record in Limpopo province (Petzold et al. 2014). Both records are in the western border region of the Kruger Park, suggesting a wider distribution of P. subrufa sensu stricto in the Kruger Park area.

The museum specimen from central Ethiopia (HNHM 2004.84.1; Fig. 4) was assigned to one of the two distinct lineages of P. somalica (Fig. 2). Consequently, it represents the first unambiguous record for P. somalica in Ethiopia and outside Somalia. The localities of P. somalica in Somalia (Petzold et al. 2014) are approximately 480 km away from the site in central Ethiopia. In contrast to this specimen, the helmeted terrapin from southern Ethiopia was revealed as P. neumanni (Figs 2 and 5), a species previously only known from Kenya and Tanzania (Petzold et al. 2014). The nearest genetically verified locality of P. neumanni lies in Kenya (South Horr, Marsabit; Petzold et al. 2014), approximately 320 km distant from the record in southern Ethiopia. It seems possible that the ranges of P. neumanni and P. somalica abut or overlap in the region of the Great Rift Valley lakes of Ethiopia, even though our records of the two species are approximately 470 km apart.

We cannot exclude the possibility that more species of Pelomedusa occur in Ethiopia. As outlined above, Petzold et al. (2014) reported two genetically verified historical museum specimens from ‘Abyssinia’, one representing P. somalica (voucher in the Naturhistorisches Museum Wien, NMW 24449, coll. Carlo von Erlanger 1899-1901) and the other P. gehaifie (voucher in the Museum für Naturkunde Berlin, ZMB 15693, coll. William Jesse 1868). Abyssinia was identified by many 19th and early 20th century authors with what is now Ethiopia and Eritrea (e.g. Rüppell 1835; Finsch 1869). When the itinerary of Carlo von Erlanger is considered (Pagenstecher 1902; von Erlanger 1904; Sprigade 1904), it is likely that NMW 24449 (P. somalica) was collected in present-day Ethiopia, whereas the itinerary of William Jesse (Finsch 1869: plate 23) suggests for ZMB 15693 (P. gehaifie) an origin in Eritrea. Nevertheless, P. gehaifie could occur in Ethiopia because helmeted terrapins are known from the region of the Blue Nile (Largen & Spawls 2010; Fig. 1). This river con-

Table 1. Helmeted terrapins examined for the present study. Abbreviations: HNHM – Hungarian Natural History Museum, Budapest; MTD – Museum of Zoology, Senckenberg Dresden (Tissue Collection).

<table>
<thead>
<tr>
<th>Sample/Voucher</th>
<th>Collection site</th>
<th>Coordinates</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTD 13906</td>
<td>North of Humansdorp, Eastern Cape, South Africa</td>
<td>333.9560 E24.80102</td>
<td>7 October 2010</td>
</tr>
<tr>
<td>MTD 13904</td>
<td>Rooipoort Guest Farm, Northern Cape, South Africa</td>
<td>330.3008 E24.9653</td>
<td>30 September 2010</td>
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<tr>
<td>MTD 13593</td>
<td>Bekaphane Pan, Hluhluwe-iMfolozi Game Reserve, KwaZulu-Natal, South Africa</td>
<td>28.27952 E31.81980</td>
<td>30 November 2014</td>
</tr>
<tr>
<td>MTD 13589</td>
<td>Sabie Park, close to Paul Kruger Gate, Mpumalanga, South Africa</td>
<td>24.97766 E31.47960</td>
<td>22 November 2014</td>
</tr>
<tr>
<td>MTD 13014</td>
<td>Near Buska Lodge, 3 km E Turmi, Omo Region, Ethiopia</td>
<td>N4.97444 E36.51583</td>
<td>15 July 2014</td>
</tr>
<tr>
<td>HNHM 2004.84.1</td>
<td>Koka Lake, Oromia Region, Ethiopia</td>
<td>N8.39053 E39.07989</td>
<td>Early 1960s</td>
</tr>
</tbody>
</table>
nects Ethiopia with the region of Khartoum, Sudan, from where a questionable record of *P. gehafie* exists (Petzold et al. 2014). It is most likely that NMW 24449 is one of the specimens collected by Carlo von Erlanger and Oscar Neumann on 20 June 1900 south of the Shebelle River (= Wabbi or Webbi River, Oromia Region, Ethiopia, approx. N7.80000 E41.00000; Neumann 1905; Tornier 1905). NMW 24449 has on the right side of the carapace an additional fifth costal scute (Fig. 6), exactly as described by Tornier (1905) as an abnormality for one of the seven specimens from von Erlanger’s and Neumann’s

![Maximum Likelihood tree for 189 Pelomedusa terrapins, rooted with Pelusios sinuatus. The tree is based on the 1848-bp-long alignment of mtDNA used by Petzold et al. (2014) and Nagy et al. (2015) plus sequences from the six terrapins studied for the present paper. Chimerical sequence data from a helmeted terrapin from Swellendam, Western Cape, South Africa, were excluded (see Petzold et al. 2014). Numbers along branches indicate bootstrap values greater than 50 (not shown for terminal clades with short branch lengths). Terrapins discussed in the present paper are highlighted in orange. For explanation of other sample codes, see Petzold et al. (2014) and Nagy et al. (2015). Inset: Pelomedusa neumanni, Omo Region, Ethiopia.](image_url)
**Fig. 3.** *Pelomedusa subrufa* sensu stricto (adult male, Sabie Park, close to Paul Kruger Gate, Mpumalanga, South Africa; S24.97766 E31.47960), straight carapacial length 11.0 cm. Dorsal and ventral aspect. The black triangles on the submarginals are characteristic for hatchlings of *P. subrufa* (Fritz et al. 2015) but often lost during growth. Photos: Uwe Fritz.

**Fig. 4.** *Pelomedusa somalica* (HNHM 2004.84.1, adult male, Koka Lake, Oromia Region, Ethiopia; N8.39053 E39.07989), straight carapacial length 23.4 cm. Dorsal and ventral aspect. Photos: Judit Vörös.
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expedition. NMW 24449 represents the same genetic lineage of *P. somalica* as previously identified from a single fresh Somali sample (Rugi, Awdal Region, N9.96980 E43.43250; Petzold et al. 2014), whereas the specimen from Koka Lake (HNHM 2004.84.1) belongs to the other highly distinct lineage of *P. somalica*. Until now, the latter lineage was only known from three terrapins from the vicinity of Borama (Awdal Region, Somalia, N9.97050 E43.14600; Petzold et al. 2014). If both lineages should turn out as distinct species, Ethiopia would harbour at least three species of *Pelomedusa*.

**Fig. 5.** *Pelomedusa neumanni* (adult male, near Buska Lodge, 3 km E Turmi, Omo Region, Ethiopia; N4.97444 E36.51583), straight carapacial length approximately 20 cm. Lateral and ventral aspect. Photos: Tomáš Mazuch.

**Fig. 6.** *Pelomedusa somalica* (NMW 24449, juvenile, most likely collected by Carlo von Erlanger and Oscar Neumann on 20 June 1900 at a site named Oda, south of the Shebelle River, Oromia Region, Ethiopia; approx. N7.80000 E41.00000), straight carapacial length 7.6 cm. Dorsal and ventral aspect. This terrapin shows an abnormal carapacial scutation with five costal scutes on the right side, as described by Torner (1905). Photos: Melita Vamberger.

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References


